The Birth of Thermal Utilities:
Mapping the Journey to a Thermal Market

Presented Live at the NY-GEO 2023 Conference Albany, New York on April 27, 2023

Moderator:

Audrey Schulman / *HEET*

Panel:

Zeyneb Magavi / *HEET*

Jonathan Bounocore / *Boston University School of Public Health*

David Podorson / *Xcel Energy*

Will Hardesty-Dyck (video) / *Eastie Farms*

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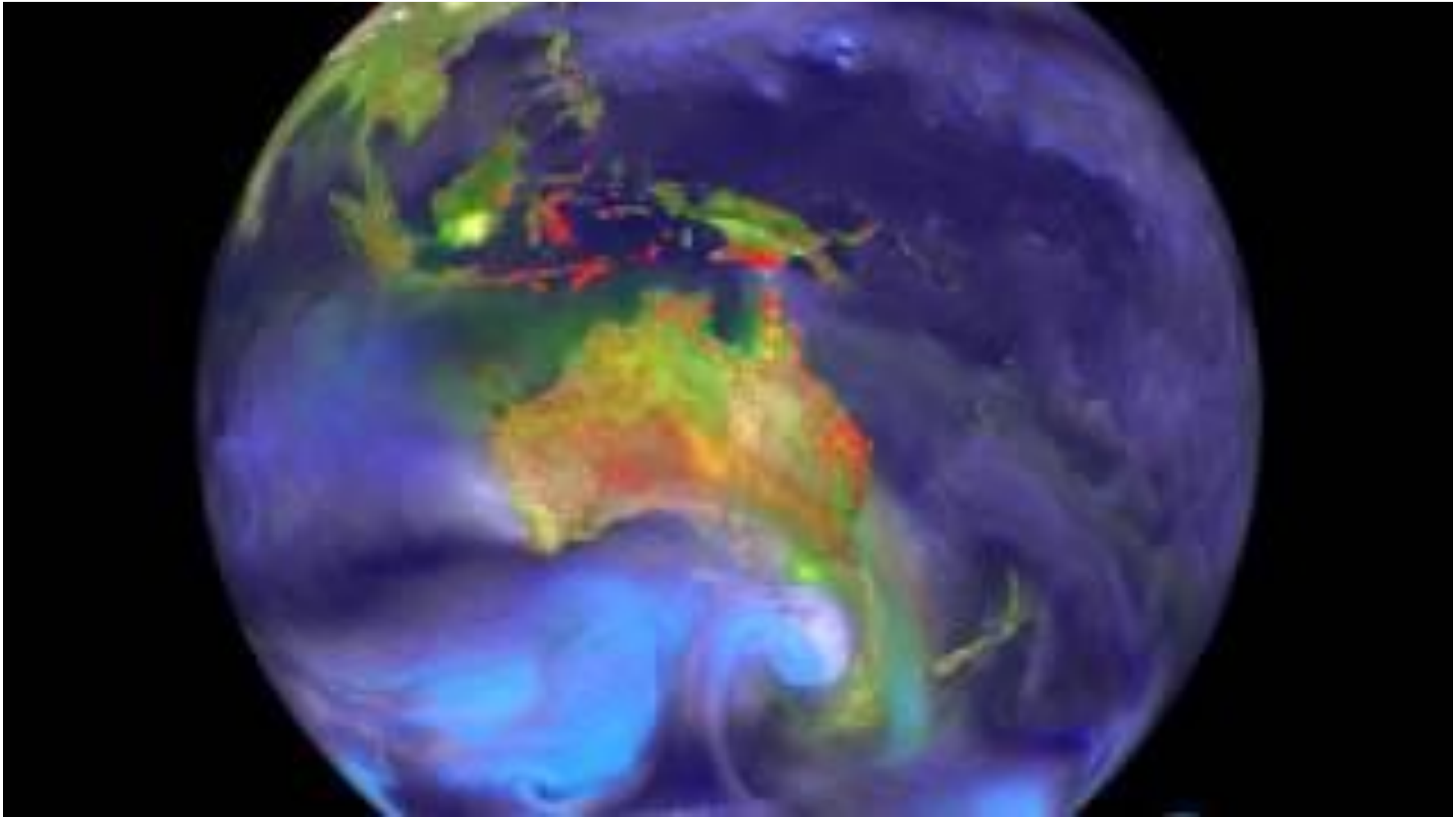
Three Ways That Heat Pumps Can Benefit Public Health

Other than through providing heating and cooling

Jonathan Buonocore, Sc.D., Assistant Professor, Boston University School of Public Health



1) Heat Pumps Can Reduce Air Pollution Emissions From Buildings

- Electricity from coal was the major source of health impacts in 2008
- Now, gas and biomass in buildings have as large of an impact, along with industry and remaining coal
- “Swapping out one combustion fuel for another is not a pathway to a healthy energy system”

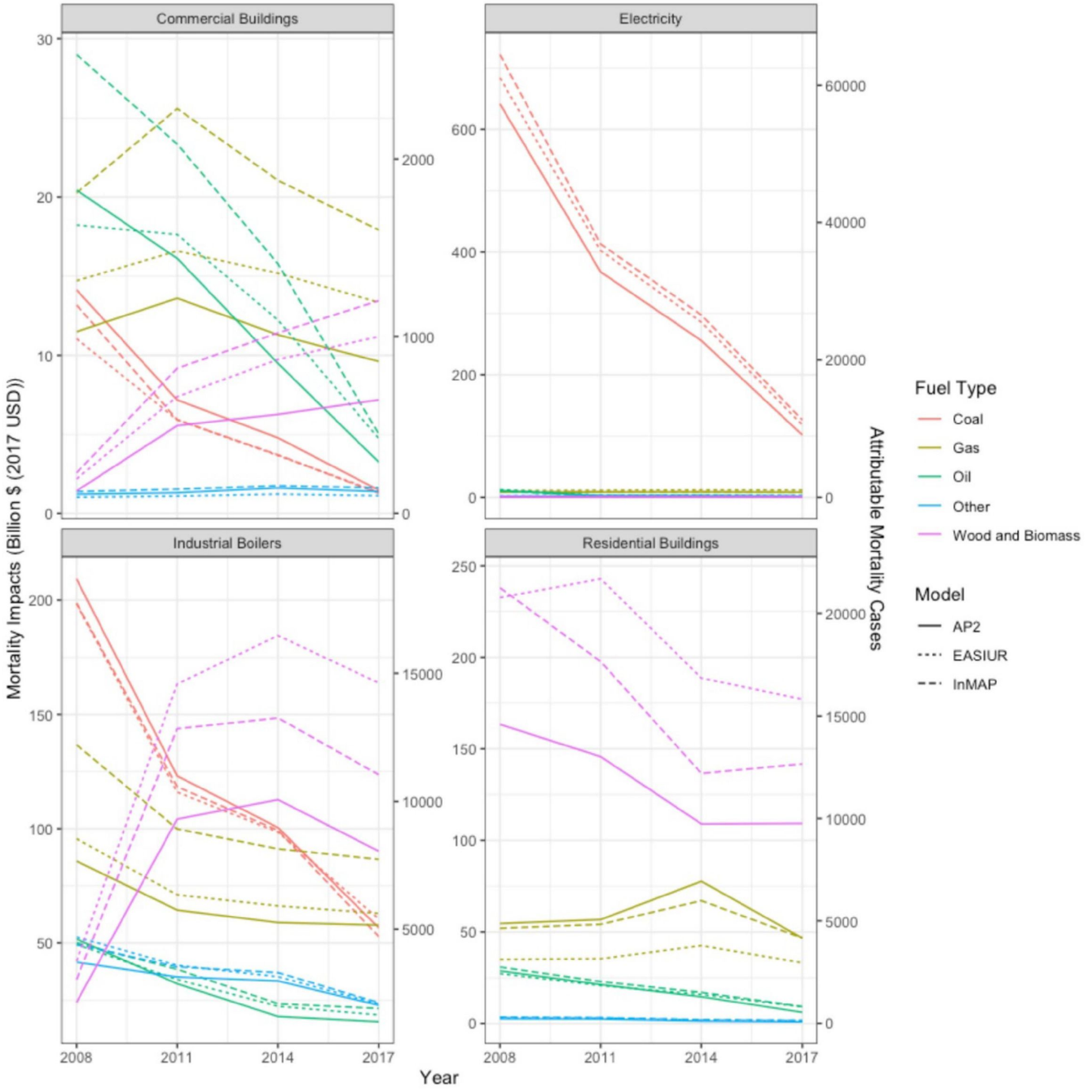
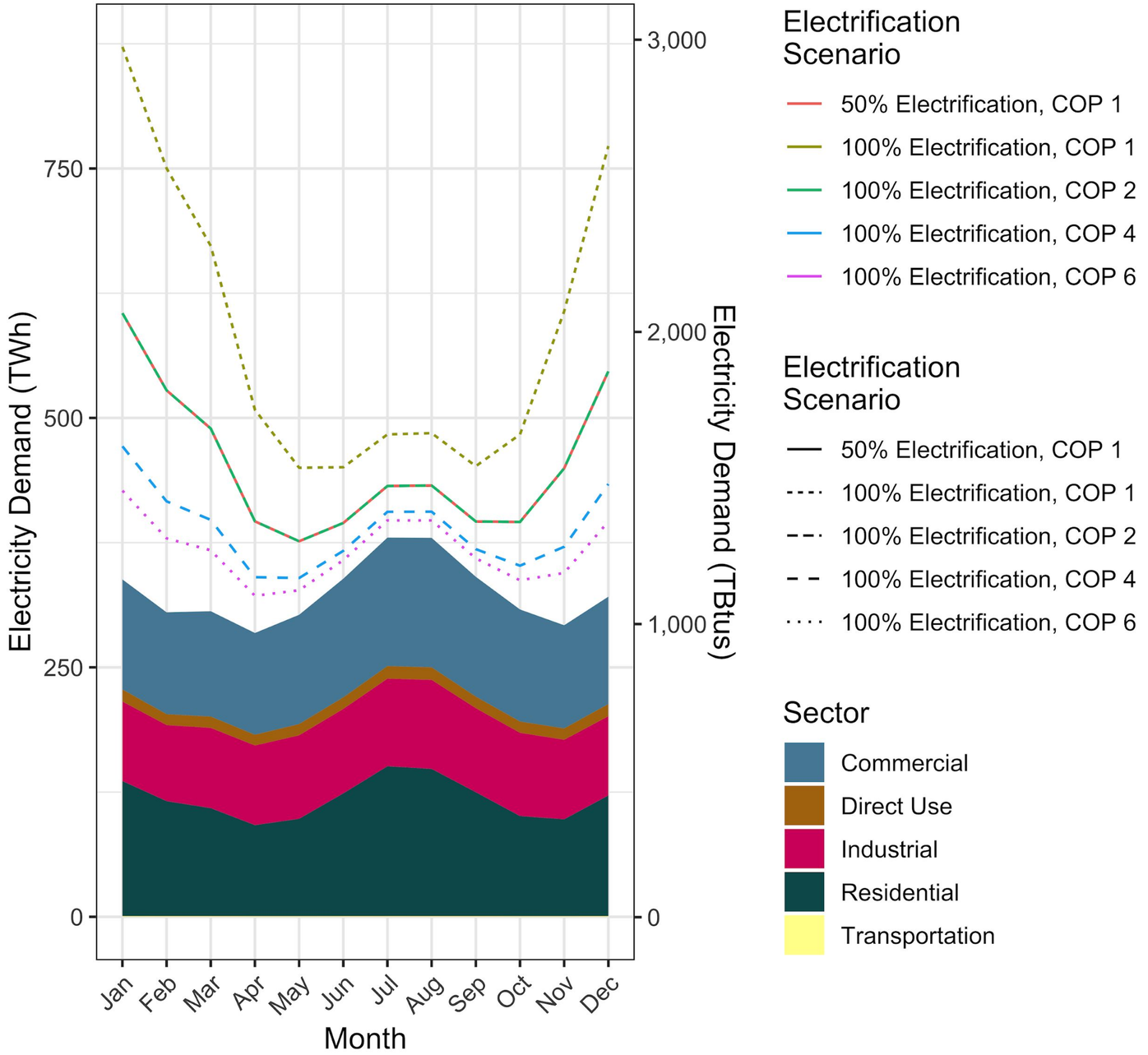


Figure 1. Trends in the U.S. mortality impacts from $PM_{2.5}$ exposure from 2008 to 2017 for stationary source categories with a specific fuel type listed, by fuel type and sector.

Buonocore, *et al.* 2021, Env. Research Letters

2) Efficient Heat Pumps Reduce Grid Load and Consequent Emissions

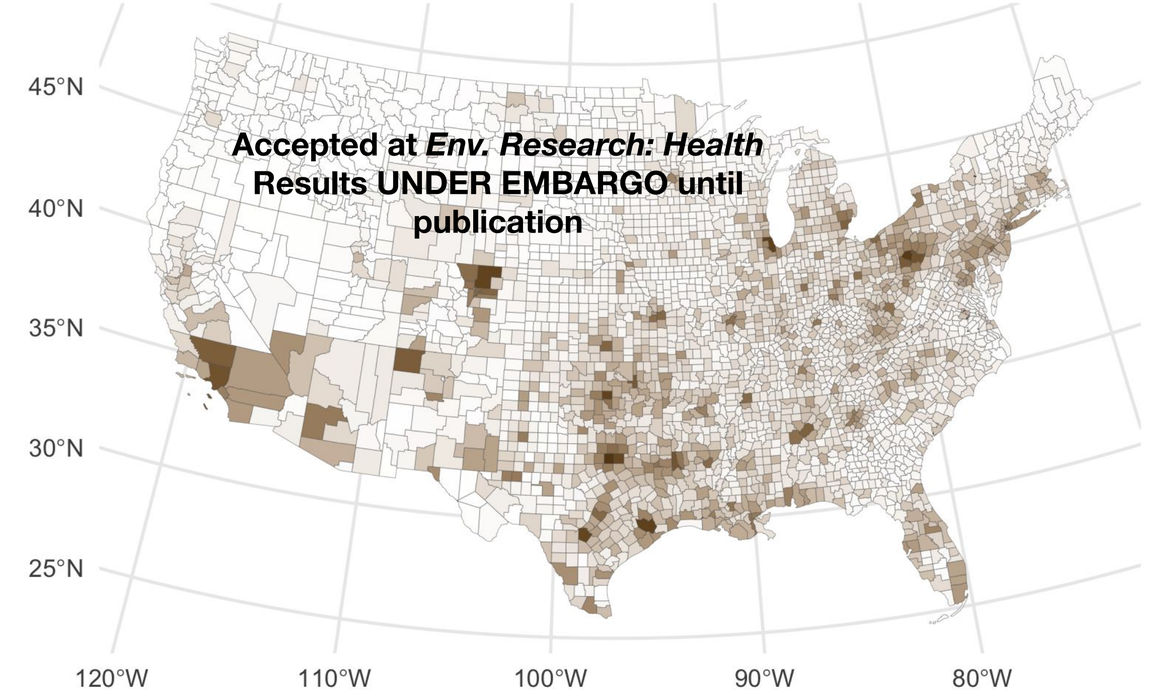
- **Electrifying all fossil fuel use in buildings "tomorrow" puts large load on grid, especially in winter**
- **Difficult to meet with wind, solar and/or storage**
- **May increase/prolong use of fossil fuels or biomass for power**
- **May encourage renewable natural gas or hydrogen, which still produces air pollution**

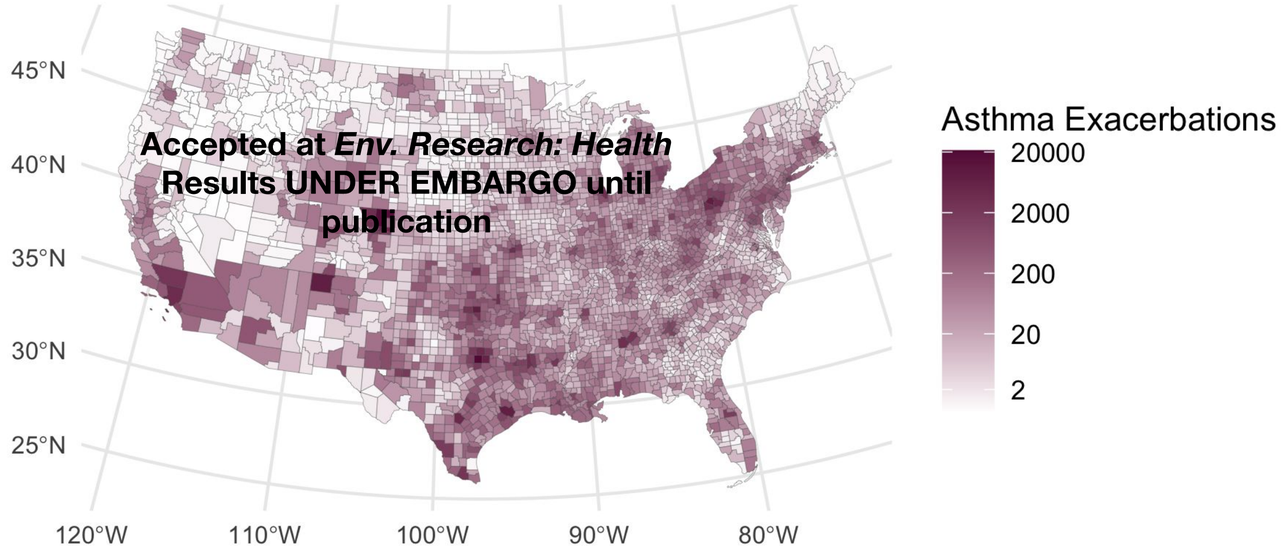


Buonocore *et al.* 2022, *Nat. Sci. Rep.*

3) Reducing Gas Production Can Have Major Health Benefits

- Oil & gas production health burden is 7,500 deaths per year, 2,200 new asthma cases, and 410,000 asthma “attacks” per year
- Just regional air pollution, not local hazardous air pollution exposure or water pollution
- Separating oil impacts from gas is challenging, but in progress





Buonocore *et al.* 2023, *Env. Research Health*

Conclusions

- **Heat pumps (especially efficient ones) could have big benefits for public health and climate**
  - **Can reduce air pollution from buildings**
  - **Can reduce total air pollution, if powered by renewables**
  - **Could reduce impacts from gas**
- **Energy infrastructure could be a major determinant of public health**
- **This requires public health to *actually be at the table***

Thank you!

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XCEL ENERGY'S PERSPECTIVE ON COMMUNITY GROUND SOURCE HEAT PUMPS (PENDING FURTHER ANALYSIS)

David Podorson, Senior Product Developer

•April 26, 2023

Xcel Energy Has a Goal of Being Carbon Neutral by 2050

Final portfolio of resources and technology to accomplish has not been determined

OUR COMMITMENT

Net-Zero Energy Provider by 2050

We aim to power your life with energy that has net-zero emissions.

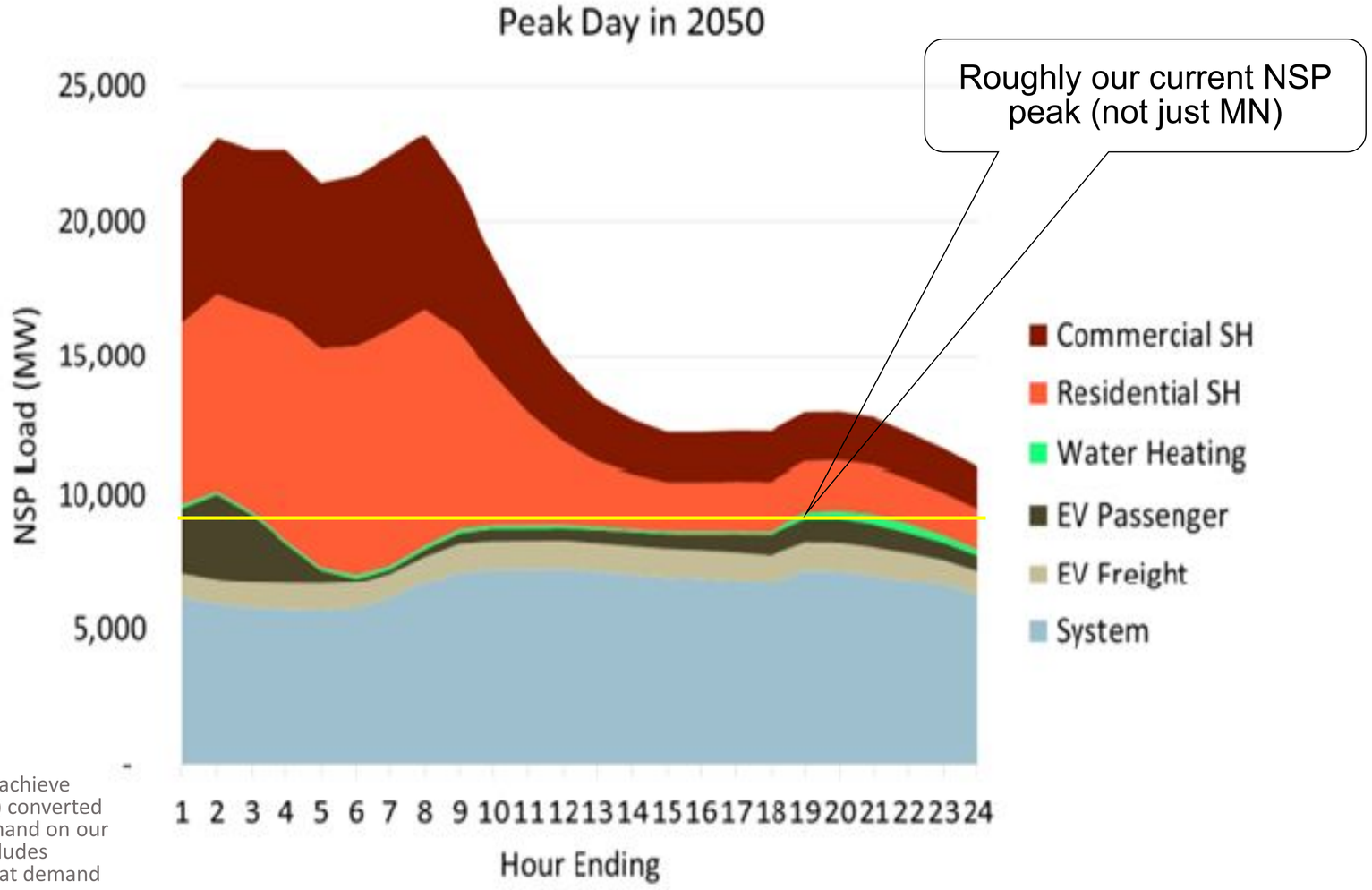
View Our Progress

On a Peak Cold Day, Heating Trumps All Loads

Space Heating

Electric Vehicles

Everything Else



•Modeling for Xcel Energy's system by Energy & Environmental Economics (E3) to achieve 80% decarbonization. If most of our customers (both residential and commercial) converted their heating equipment to ASHPs with electric resistance backup heat, peak demand on our electric system would increase by roughly 2.5 times what we have today. This includes aggressive energy efficiency measures as well. Figure shows the breakdown of that demand by end use, on NSP's system in Minnesota.

According to MNCEE, ASHPs Are Not Going to Advance Enough To Handle Peak Cold Conditions Efficiently

Current Generation

- NEEA ccASHP specs
- Capacity @ 5 F > 70% rated
- COP @ 5 F > 1.75

2022

2025

Future Generation

- DOE ccASHP Challenge
- Capacity @ 5 F = 100% rated
- COP @ 5 F > 2.4

Imaginary Future Systems

- Modeled by the MNCEE
- Capacity @ -25 F >= 90% rated

Never

- Researchers modelled hypothetical future ASHPs of unparalleled performance, and still found that these systems would drive unprecedented winter system peaks.
- Furthermore, this analysis was only performed at the design temperature, which doesn't account for true peak cold events of 1h, 8h, 1day, or rare polar vortex events.

•Legend:
- NEEA: Norwest Energy Efficiency Alliance
- DOE: Department of Energy
- MNCEE: MN Center for Energy and Environment
- COP: Coefficient of Performance
- ASHP: air source heat pump
- ccASHP: cold climate ASHP

Community GSHPs Can be the New “Steel For Fuel”

Analogous to Xcel Energy’s wind strategy

- Significant opportunity for rate-based capital investment in the existing gas system
- Displaces fuel costs with infrastructure costs
- Increases revenue, and avoids future costs
- Customers may get lower cost heating (and cooling) than other future scenarios
- We lead the clean energy transition

Pending further investigation

All Our Priorities Can Be Aligned

Traditional Decarbonization

- Keep the gas utility model in place
  - (−) Rising costs for the most vulnerable, costly and challenging to maintain
- Build new electric generation
  - (−) Massive investment, increases rates, difficult to decarbonize
- Utilize renewable fuels
  - (−) More expensive, limited availability, massive investment

Community Ground Source Heat Pumps

- Keep the gas utility model in place
  - (+) Stabilizes rates, equitable maintenance
- Build new electric generation
  - (+) Less investment, maintains low rates, easier to decarbonize
- Utilize renewable fuels
  - (+) Use less, reserve for systems that are difficult to decarbonize, create from lower hanging fruit

Will Hardesty-Dyck

Eastie Farms


Will HD

Thank you!

info@heet.org | gastogeo.wiki | heet.org

Join us! Hors d'oeuvres & signing of the **Declaration of Thermalfication!**

6:00 PM, Empire Room